

DEVELOPMENT OF NEW CANNED MEATS FOR OPERATIONAL RATIONS

One answer to complaints of monotony of diet, sometimes voiced when packaged rations have to be used over too long a period, is to increase the variety of components in the total ration. Another method of approach is to diversify the flavors, types, or form of a given component wherever this is possible. Canned meat items, new in whole or in part, may not altogether alleviate the desire for fresh meat, but they will contribute much toward doing away with the deadly feeling of "sameness" in diet as it pertains to meat—deadly because of its severe effect on over-all morale. The following article is an account of the careful procedures involved in the development of new and improved canned meat "weapons" for the military ration arsenal.

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For purposes of military definition a canned meat item is classified as "new" if it has not heretofore been used for military subsistence purposes. This new product may or may not have a commercial counterpart, and may consist either of all meat or of meat in combination with vegetables, alimentary pastes, gravies, or even fruit.

At present, a particular need exists for the development of additional canned meat items to meet the specialized needs of ground troops operating under various adverse conditions, of submariners, and of airmen. The American standard of living and national dietary customs dictate that variety in foods be provided for the Military Services. However, variety is but one answer to the complicated problem of operational feeding.¹ Presupposing that the requirements for nutritional adequacy and product stability are met, the problem of acceptability remains unanswered. The

¹ An operational ration can be considered to be a prepackaged quantity of food designed to meet the feeding problems of individual or group feeding under various conditions of global military operations, imposed by modern land, sea, or air combat.

most nutritious food is useless unless eaten. Under conditions of stress, a soldier can lack appetite completely yet require "fuel" for the strenuous work of fighting. Certain other factors of military significance merit consideration in planning canned meat developmental work. For example, items must be designed to avoid duplication in other rations, to create a reserve of items to meet changes in acceptability or use requirements, and to ease the burdens incurred in large-scale procurement through the use of as many different raw materials as is practical.

some typical problems encountered

Many problems not at first apparent become evident as the development of a new item progresses. For instance, the existence of a patent covering some phase of processing or handling can be a complicating factor. Assurance of chemical and microbiological stability is a prerequisite for any new canned meat item for military use and this involves accumulation of storage study data on all new items. In addition to the ravages of time and extreme fluctuations in temperature,

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the military item is subjected to rough physical handling. Some raw materials which may be considered for inclusion in a new product may not be suited for military use because of their instability, lack of availability in large quantities, or strict seasonal availability. Certain other ingredients may alter the product in such a manner as to have a deleterious effect on container efficiency.

Since methods of preparation must not be restrictive in nature, developmental activities often involve investigation of different processes for achieving the same end product. An example would be the studies necessary to evaluate the different methods of precooking hamburger patties prior to canning, i.e., grill frying, deep-fat frying, infra-red broiling, or gas-heated ceramic broiling. In short, the product should be possible to manufacture in large quantities, by many manufacturers, and in all parts of the country.

The acceptance problem as presented by military foods, with special reference to operational ration canned meats, is much different than that which the commercial canned meat products present. The military canned meat item may have to be eaten cold and therefore the fat content, moisture content, texture, and general appearance are as critical as flavor. To complicate the acceptance problem further, the serviceman is oftentimes required to consume the item while under stress. The stress situation may act to dull the appetite and intensify the critical opinion the serviceman may initially possess with regard to his food. The varied taste preferences of citizen soldiers emanating from all walks of life, from all parts of the country, and of varying age, educational, and social levels must be reduced to a

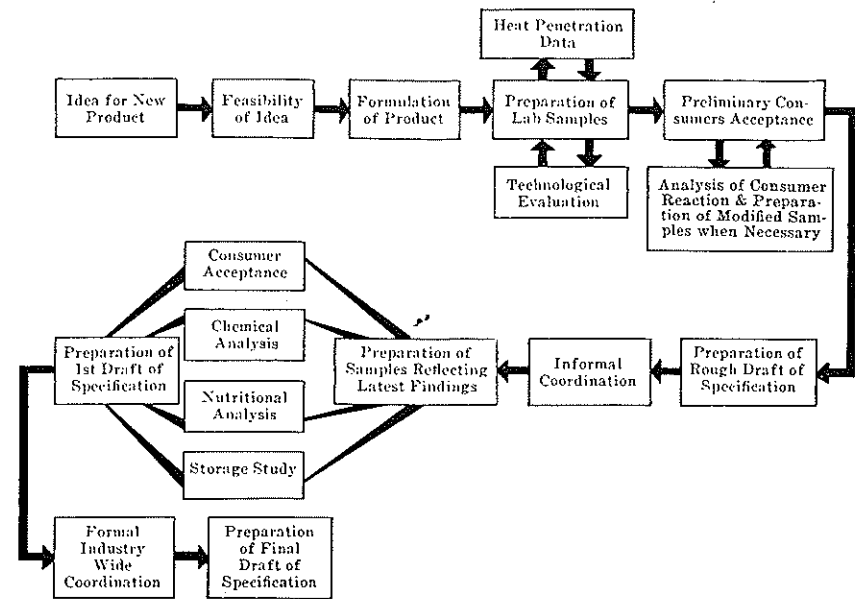
common denominator. The new item must taste "just right" to the majority of potential users. It must not be too bland or salty, too dry or moist, too peppery or mild.

the developmental program of the qmfci

To spotlight the thoroughness of developmental studies on new canned meat items, it might be in order here to take a closer look at the canned meat developmental program of the Animal Products Division, QMFci (see Figure 1). This program represents a concerted approach to the problem of providing new canned meats for Armed Forces use. The idea for a new product may be original with the problem investigator or it may be based on an established home recipe or a specialty of some quality restaurant. It may be obtained from published works on cookery and be adapted to fit the need of the Armed Forces, or it may be offered to the Military by commercial canned meat producers.¹ The basic recipe must be acceptable in taste and appearance and must represent a "natural combination." The initial consideration given an idea is based upon proven or contemplated consumer preference. The technological aspects are next considered—that is, is the formula well suited for canning and what is its potential stability and field utility?

¹ In addition to ideas originally conceived by the canned meats group of the Animal Products Division, credit must be given to members of the Associates for their suggestions and developmental assistance. Other members of the canned meats industry have also been very helpful and generous of their time, personnel, and facilities. Many of the outstanding developmental personnel responsible for new commercial canned meat items have cooperated during the past several years in an attempt to increase the number of canned meats available for Armed Forces use.

Figure 1. Development of New Canned Animal Products



Preliminary consideration also involves past experience with production of similar items, commercial or military. If the item appears practical, formulation studies will be undertaken. During formulation studies, the proportion of various ingredients is determined to establish meat, generally, as the principal ingredient on a weight basis. The facilities of the Animal Products laboratory are used to the fullest extent possible in the initial formulation studies. However, initial canning experiments may be conducted in laboratories of a member of the Associates if the equipment is not available in the Institute laboratories, or if personnel of the cooperating organization possess specialized experience applicable to the new product.

During initial formulation studies in the laboratory, those methods of

handling, trimming, preparation, cutting, and filling, etc., which are used in large-scale production are utilized. Care is exercised to use standard and readily available ingredients. Exacting procedures are used in the formulation studies and accurate records are kept on the developmental procedure. Varying formulae, piece size, accurate weights, precooking times and temperatures, filling procedure, filling difficulties, vacuum at sealing, and retort time and temperature are but a few of the important factors noted during the initial investigations. When different formulae or techniques are used, control samples are prepared simultaneously. Information gathered during the basic formulation studies becomes very valuable during subsequent experiments, specification preparation, and initial plant production. Initial laboratory pro-

duction samples are examined thoroughly by technologists of the Animal Products Division. The quality of the new item is the chief concern. The effects of high-temperature processing are noted. The flavor, color, texture, odor, and general appearance of the new item is evaluated. The moisture and fat contents and their effects upon quality are noted. Gross physical changes such as volume reduction or increase are noted. The general "canability" of the new formula is determined at this examination. If the product meets the expectations of the examining technologists, it is forwarded to the appropriate testing group (Experimental Cookery Division, QMFCI) for preliminary consumer evaluation.

Samples forwarded to the Experimental Cookery Division for testing are served cold or heated, depending upon intended ration use, to a panel of from 20 to 30 testers. The testers are civilian and military personnel of both sexes and different age levels. The samples are scored on a 9-point hedonic scale. The scale contains ratings from 1—"dislike extremely" to 9—"like extremely" with 5 as a neutral position indicating neither like nor dislike. Both sides of the mid-point on the scale have the words, "slightly," "moderately," and "very much," modifying both the "like" and "dislike" ratings. In addition to assigning a numerical rating to the item being tested, the testers are invited to comment on any factor affecting the quality of the product. The product must receive an average score of 6.5 or higher with not more than 15 per cent of the testers scoring in the dislike range. It should be pointed out that the initial consumer preference test is designed to determine a predicted level of acceptability and is used to bring to light any adverse comments that a consumer might

consider worthy of presenting. The testing consumer is an individual who is detached from any personal interest, is unaware of the technological aspects of the product, and is concerned only with its sensory qualities. Results of initial testing are confirmed by subsequent tests and by eventual using-Service acceptance.

If the product acceptance test rating is low, the technologist concerned with the development of the new item utilizes the comments of the test panel and his own observations to reformulate the product in an attempt to improve its quality. The military characteristics of the product and the soundness of the technological factors involved are important considerations in determining the desirability of continuing work on the original idea. Attainment of maximum acceptability by the majority then becomes the paramount goal. The levels of seasoning must be adjusted so that the product is not thirst provoking. Fat levels must be adjusted to augment eye appeal and not adversely affect texture, flavor, or nutritional value. The physical state of the product depends largely upon the moisture content, yet the costs of storing and shipping water are prohibitive. This problem also must be coped with. The psychology of nomenclature is another important factor to consider. Product names containing words like "hamburger," "steak," and "sausage" are much more appealing than names containing words like "stew," "hash," or "chopped."

When a proposed new product is modified to reach the desired level of perfection it is again submitted to the Experimental Cookery Division for retesting. If it meets the established preference level, initially or upon retesting, it is then ready for final preference rating. Final pref-

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erence testing, preliminary to specification activities, is conducted by the Acceptance Division, QMFCI. Here the product must score equal to or higher than the average preference value for canned meats already in the ration. The same 9-point hedonic scale is used as in the initial consumer test.

Attainment of the desired level of preference qualities is followed by nutritional and chemical analyses. The vitamin, mineral, protein, and caloric levels must be known in order that the ration, of which the new item will become an integral part, may be balanced to assure specified nutritive levels. Chemical composition must be determined in order that sound end product controls may be established in the covering specification. The pH of the product must be determined because of its important relationship to the efficiency of the protective function of the can.

the importance of heat treatment

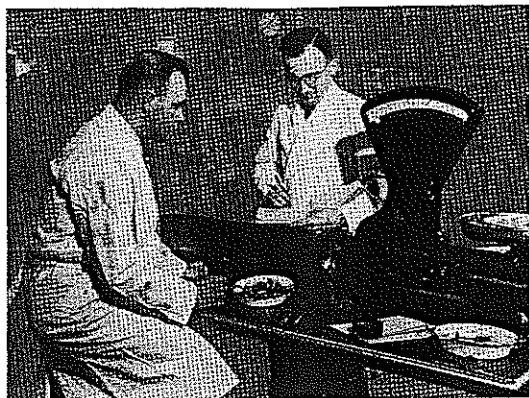
Careful consideration of the sterilizing heat treatment given experimental samples is considered to be an essential step in the development of canned animal products. This heat treatment of the sealed can culminates all the developmental operations applied to the manufacture of the product and is of such importance as to have a direct effect on the quality of the finished product. It is well known that an excessive heat treatment is detrimental to quality in canned foods just as it is only too well known that an inadequate heat treatment may result in future bacterial spoilage. Thus, every effort is made to subject new experimental canned meats to proper heat treatments so that subsequent evaluations will not be influenced by the better organoleptic quality of possible underprocessed material, or

by the poorer quality of an over-processed product.

To determine the adequate sterilizing heat-treatment requirements for all new items, heat penetration tests are made in the conventional manner. The equipment used is that described by Ecklund. Modified formula or graphical methods of process calculations are used to evaluate the heat penetration data. The sterilizing values used in calculations are based on the experiences of the Animal Products Division as well as unpublished authoritative information received from other research and developmental organizations. The determination of heat penetration data by the Animal Products Division is primarily a routine factor in the new canned meats developmental program of the division. The data thus obtained is not supplied by the Animal Products Division to producers of canned meats for the Armed Forces, but is made available to the various can manufacturing companies who frequently function in an advisory capacity to their customers. This information is used at the discretion of the can companies. The final processing responsibility rests with the canner.

The stability or keeping quality of the new product must then be determined. Samples of the new product which have received the proper degree of heat processing are placed in storage. The temperatures of the storage rooms are well regulated. The samples are stored at 100° F. with a like number of control samples stored at 40° F. The minimum product stability standard for canned meats is six months at 100° F.² Vis-

² A practical minimum stability requirement of soundness after six months' storage at 100° F. is used in developmental work. An ultimate minimum stability requirement of soundness after one year of storage at 100° F. has been established for all canned animal products.



The authors conduct a technological examination of a newly developed canned meat item, determining and recording the quality of the product with regard to color, odor, texture, and flavor.

ual inspection is made of the samples stored at 100° F. once every two months until the end of the six-month period. The visual inspection includes examination of the can ends for distortion and can seams for leakage.

writing the specification

When the product is placed in storage the technologist concerned with the development of the item turns his attention to the preparation of the commodity specification. Every attempt is made to avoid an elaborate, complicated, or stringent specification. The specification writer is required to use understandable, simple language and his terminology must be acceptable to the applicable commodity field. He is encouraged to solicit the guidance and aid of experienced food scientists and production personnel. His chief responsibility is to accurately define and describe (1) the raw material requirements, (2) the product formula, (3) the usable manufacturing procedure, and (4) the end product requirements and proposed test methods. While restrictive requirements must be avoided, descriptions must be detailed enough to assure delivery of "intended" items re-

gardless of the location or facilities of the manufacturer.

When the rough draft of the commodity specification is prepared it is ready for circulation among appropriate divisions of the QMFCL, among those producers who have cooperated in the development of the item, and among those who have had the most experience with producing a similar item commercially. This initial circulation of the rough draft is termed "informal coordination." This informal coordination is conducted by the Animal Products Division, QMFCL, and is concerned only with the commodity section of the specification with no reference to packaging or packing requirements. Those who receive the rough draft are requested to comment on all aspects of the specification which may be considered to be impractical, unsound, unworkable, confusing, or which might in any way contribute to production difficulty or result in an inferior end product. These comments and any other pertinent developmental findings are utilized in the rewriting of the rough draft into a first draft. The first draft, reflecting all findings to date, is then sent to the Specifications Office, QMFCL, for appropriate action.

The Specifications Office is supplied with all of the necessary background information. With the receipt of the first draft specification, the Specifications Office establishes a "case file" for the new product. From this point on any information related to the new product is entered in the case file. The specification is then forwarded to the Container Laboratories for the attachment of packaging requirements. The completed first draft of the specification is then ready for industry-wide coordination. This industry-wide coordination conducted by the Specifications Office is known as "formal coordination." During formal coordination appropriate divisions within the Institute are contacted as well as other Governmental agencies and the various Military Services. A time interval of sufficient length is allowed the members of industry for the return of comments. If comments are not received by an indicated date, concurrence must be assumed. When all comments of interested and contacted parties are received and entered in the case file the specification is ready for preparation in its final form.

Some time before the publishing of the final draft the new product may be field tested. Field tests are conducted if time permits and if the item is of a different design or nature where unforeseen deficiencies may exist. Field tests will supply additional information with regard to the new item's military characteristics, field utility, individual preference, and group adaptability. A detailed account of field testing may be found in the article, "Improving Field Test Procedures" (*Activities Report*, vol. III, no. 2, July 1951). Field tests (or troop tests) confirm the solution to present problems and problems of the future undergo embryonic development.

Prior to field tests or preparation of the final draft specification, the storage studies of six months at 100° F. will have been completed. Preference studies are conducted on the stored samples. The samples after storage are fairly comparable to the product as it might be received by a soldier in the field. The test methods are the same as those used in the two preceding acceptance tests, including the rating form used. The 100° F. and the control 40° F. samples are not served simultaneously to the testers, but in random order with a several-second time interval between samples. The 100° F. sample must not score below the average for canned meats already in the ration.

With the developmental and test procedures completed and coordination activities terminated, preparation of the final draft of the specification is in order. The developmental technologist is then concerned with the resolution of comments and criticisms received during formal coordination. The final draft represents all of the knowledge gathered to date about the proposed new canned meat item. Prior to leaving the Institute for approval and publication, the specification is again reviewed by the interested divisions, both in the Food Laboratories and the Container Laboratories.

The table on page 42 indicates the specification status of new canned animal product items.

post specification problems

Despite the fact that the specification represents and reflects all that is known about the acceptability, stability, utility, chemical composition, nutritional value, production, and end product control, the technologist concerned with product

Table I. New Canned Animal Product Items—Specification Status

<i>Item</i>	<i>Specification Status</i>	<i>Preference Rating Final Preference Prediction</i>
Beef and Peas with Gravy	Approved and published	7.2
Chop Suey	Forwarded for formal coordination. Changes for final draft submitted	6.9
Ham and Gravy	Forwarded for formal coordination. Changes for final draft submitted	7.5
Spiced Beef	Forwarded for formal coordination. Changes for final draft submitted	7.1
Ravioli	Forwarded for formal coordination	7.3
Beef Steak and Potatoes with Gravy	Forwarded for formal coordination	7.6
Ham and Beans in Sauce	Forwarded for formal coordination	7.2
Ham and Potatoes with Gravy	Forwarded for formal coordination	7.1
Beef and Macaroni with Cheese Sauce	Forwarded for formal coordination	6.7
Sliced Pork with Barbecue Sauce	Forwarded for formal coordination	7.3
Tuna and Noodles with Cheese Sauce	Forwarded for formal coordination	7.4
Tuna and Noodles with Vegetables	Forwarded for formal coordination	7.4
Turkey Loaf	Forwarded for formal coordination	7.0
Salisbury Steak with Mushroom Gravy	Forwarded for formal coordination	6.9
Ham Patties	Forwarded for formal coordination	6.6
Thuringer Sausage	Eliminated as "C" Ration item; being considered as a 5-in-1 or B-Ration item	6.9
Ham and Corn	Formula developed. Samples to be prepared for further analysis	6.7

<i>Item</i>	<i>Specification Status</i>	<i>Preference Rating Preliminary Preference Prediction</i>
Turkeyburgers	Formula developed. Samples to be prepared for further analysis	6.0
Sliced Beef with Barbecue Sauce	Formula developed. Samples to be prepared for further analysis	6.8
Fried Boned Chicken, Bite Size	Pending development. Various breeding procedures being investigated	7.3
Chili Mac	Pending development. Commercial samples investigated	6.1
Chipped Beef Dinner	Pending development
Lamb Patties with Gravy	Pending development
Beef Sausages	Pending development
Meat Balls containing Rice with Gravy	Pending development

development will face additional problems. These will arise during initial large-scale production, inspection, and use. Tools and methods used in the laboratory for developmental work may tend to oversimplify potential production difficulties. Interpretation of specifications by various manufacturers may differ. A laboratory acceptance prediction may favor the product when compared to large-scale troop acceptance. The developmental technologist must be aware of the entire

performance of the newly developed item and must be in a position to offer advice to procurement, inspection, and manufacturing personnel. He must be in a position to utilize production, inspection and user information to the betterment of the product through future rewritings of the specification.

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